COMBINING FIELD MEASUREMENTS AND BIOTEST TO ASSESS LEAD AND ZINC PHYTOAVAILABILITY IN CONTAMINATED URBAN SOILS

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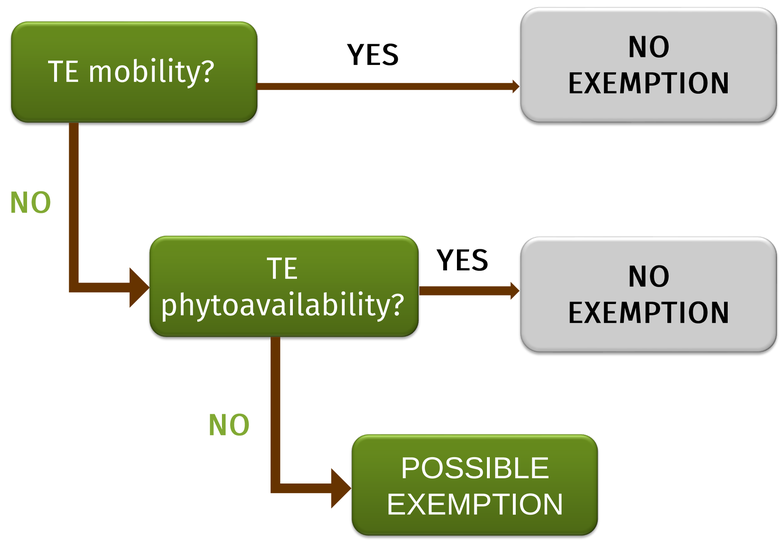
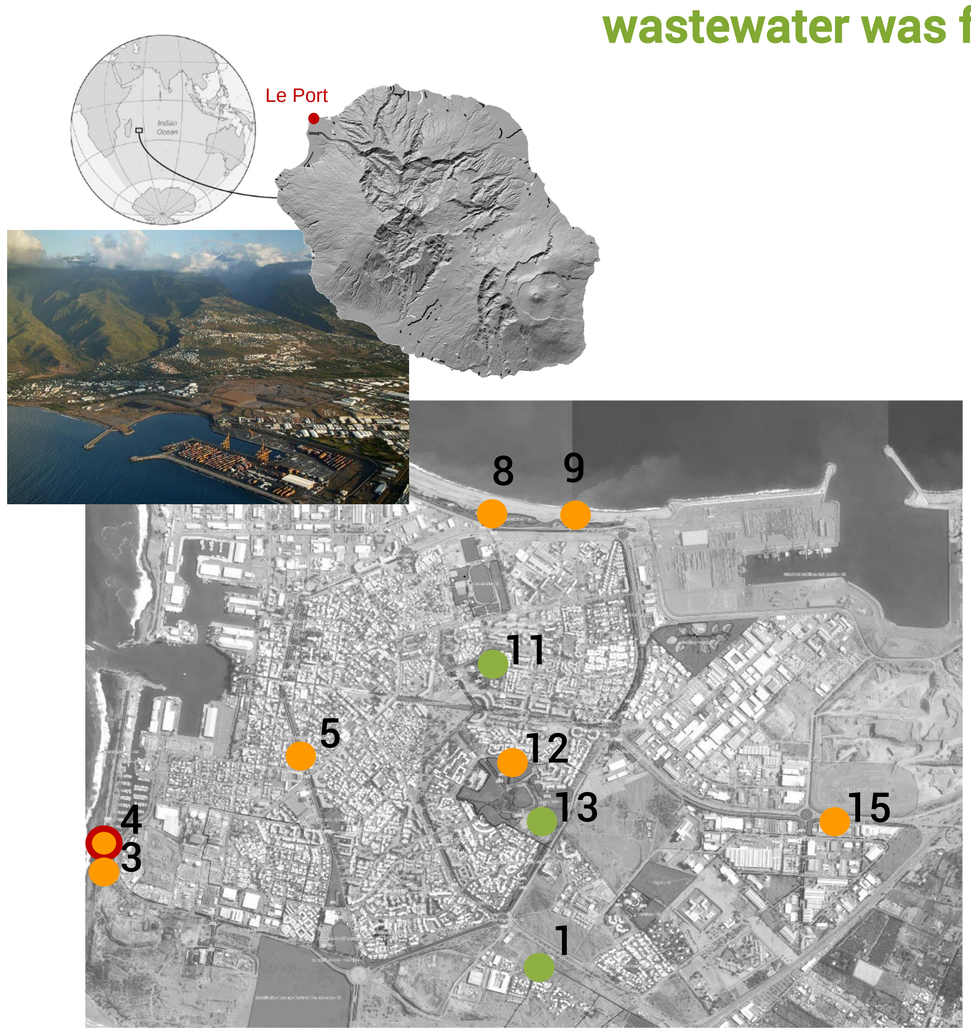
The French legislation on the recycling of wastes from wastewater treatment plants (i.e. sewage sludge and treated wastewater) forbids waste application to soil when total concentration of trace elements in soil exceed a given threshold for each trace element (TE). An exemption is however permitted for soils which exhibit a low mobility and phytoavailability of exceeding trace elements.



Guideline methodology for exemption request to recycle sludge on soils with high trace element concentrations [1]

Aims

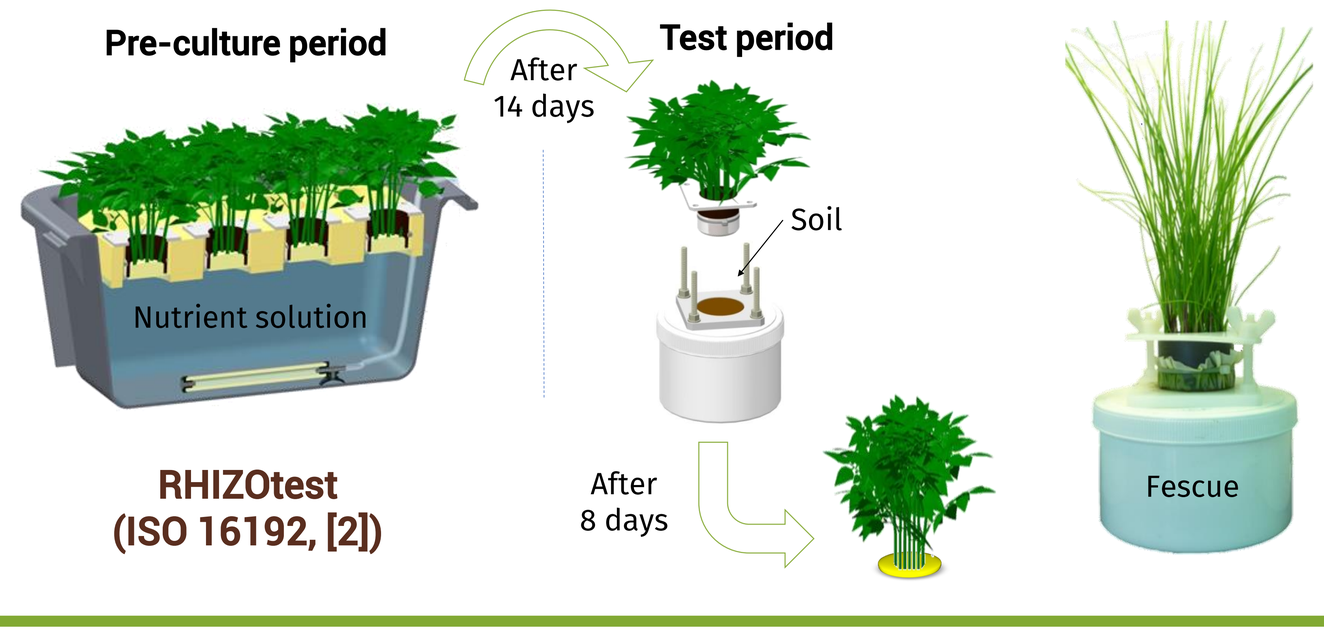
Applying the ADEME guideline methodology [1] with the combination of RHIZOtest and field measurements to lead (Pb) and zinc (Zn) contaminated urban soils on which irrigation with treated wastewater was foreseen



Sampling strategy

Material and Methods

- TE total concentrations in soils
- TE mobility estimation: $CaCl_2$ extractions
- TE phytoavailability **estimations**: NH_4NO_3 extractions
- TE phytoavailability **measures**: RHIZOtest



Results

TE Total concentrations:

- Soils 1, 11 and 13: [Pb] < 100 ppm (< thresholds, [1]) ⇨ uncontaminated references
- Soils 3, 4, 5, 8, 9 and 15: [Pb] > 100 ppm (> thresholds, [1])
  ⇨ mobility and phytoavailability analysis to conclude

$CaCl_2$ estimations of mobility:

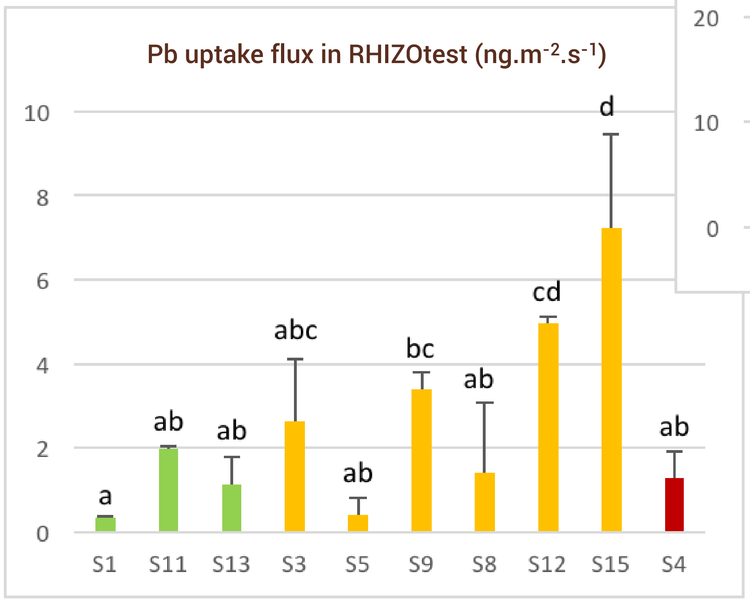
- Soil 4: mobility > thresholds for Pb and Zn [1]
  ⇨ discard from the exemption request

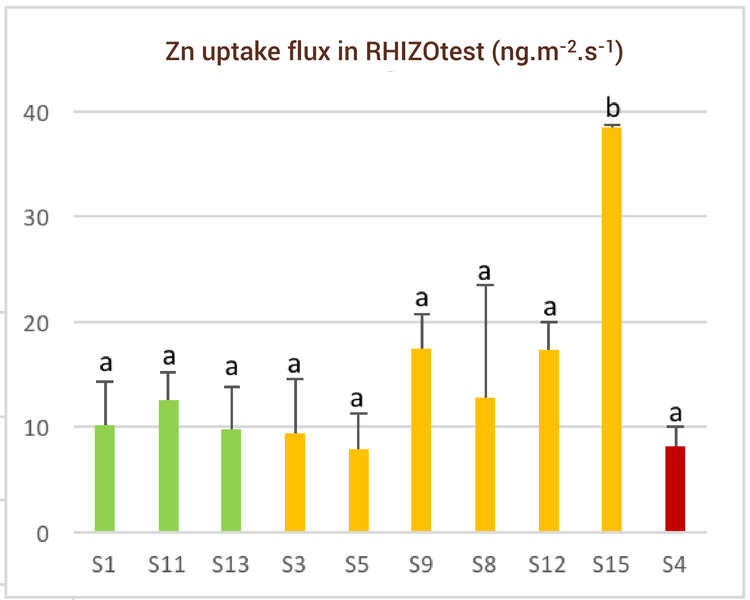
NH_4NO_3 estimations of phytoavailability:

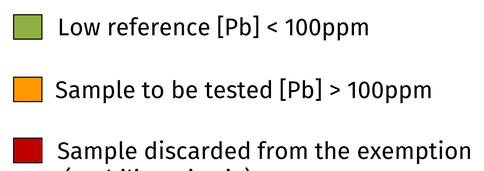
Results: low phytoavailability (estimated)

RHIZOtest measurement of phytoavailability:

Soils 3, 5, 9, 8 and 12 (Zn) = reference soils (1, 11 and 13)
⇨ possible exemption
S15 and S12 (Pb) ≠ reference soils (1, 11 and 13)
S15 was enriched in the past with contaminated composts and S12 received contaminated foreign soil
⇨ needs to be monitor







Conclusions

Exemption agreement was obtain for all soils except soil S4 (mobility criteria). But soils 12 and 15 will be monitored.
This study showed how the use of a biotest to **measure** trace element phytoavailability in combination with field measurements was useful to assess the risk in contaminated urban soils and to help exemption decision for more security.

References

[1] ADEME et APCA. 2005. Dérogations relatives à la réglementation sur l'épandage des boues de stations d'épuration. Comment formuler une demande pour les sols à teneurs naturelles élevées en éléments traces métalliques ? Guide technique. J. Béraud, A. Bispo (coord.). D.Baize, T. Sterckeman, A. Piquet, H. Ciesielski, J. Béraud, A. Bispo (authors).
[2] NF EN ISO 16198. 2015. Soil quality – Plant-based test to assess the environmental bioavailability of trace elements to plants.

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